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ABSTRACT

This is one of five volumes prepared to describe various aspects of the Del Mod System. This volume deals with the evaluation of the Del Mod System. Included are the following: (1) Del Mod Responsive Evaluation; (2) Evaluation Outcomes; (3) Validation of the Del Mod Responsive Evaluation Process; and (4) Conclusions. Appendices include: (A) Responsive Evaluation; (B) Guidelines for the Evaluation of the Del Mod System; and (C) Evaluators. Among the recommendations considered is that if a systems approach is to reach its potential, the establishment of a permanent evaluation team external to the administration of the system would be essential. (DT)

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STATE OF DELAWARE

An External Evaluation

D. Humphreys
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J. R. Bolig

FINAL REPORT

VOLUME IV

SE 021 384

AUG 1 8 1976

THE DEL MOD SYSTEM:
AN EXTERNAL EVALUATION

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JUNE 28, 1976

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FOREWORD

This report is the fourth of five final Del Mod documents. The evaluation was divided into five documents to satisfy the needs of educators who might be interested in only one aspect of the System.

The other documents contain descriptions of Del Mod's field agents, its resource centers, an overview of the System, and some statistical comparisons of pre- and post Del Mod data.

Each of these documents will be filed in the libraries of Del Mod's component institutions: the University of Delaware, Delaware State College, Delaware Technical and Community College, and the Department of Public Instruction, as well as the National Science Foundation.

Dr. John R. Bolig
Research Director

Chapter One

DEL MOD RESPONSIVE EVALUATION

Introduction

John R. Bolig
Research Director
The Del Mod System

DEL MOD RESPONSIVE EVALUATION

CHAPTER ONE

INTRODUCTION

A responsive mode of evaluating the Del Mod System was first suggested by Dr. Egon Guba in a letter to the Del Mod Director in 1975. This suggestion emanated from the criticisms of Del Mod evaluation by a number of professionals who felt that the documentation of the System was both necessary and overdue. Del Mod is extremely complex, and its assessment has always presented a difficult challenge.

Responsive evaluation, as first described by Stake (see Appendix A), was somewhat modified to fit several contingencies which existed at the time Del Mod attempted to execute it in late 1975. To cover the possibility of these modifications affecting the validity of the evaluation, Del Mod requested two validations of the process and product of the entire evaluation.

Dr. Donald Humphreys, Associate Professor of Science Education, Temple University, was asked to assess the product of the evaluation which consisted of reports written by 17 evaluators who examined Del Mod between October 9, 1975, and January 14, 1976. Each of these evaluators followed guidelines produced by this writer, and each spent two days in the on-site evaluation of Del Mod. The guidelines are reproduced in Appendix B. Humphrey's report is the second chapter of this monograph.

Dr. Kenneth Dowling, Specialist in Science Education for the State of Wisconsin, was asked to validate the process of responsive evaluation as it was fitted to the situation in Delaware. In fact, prior to its execution, Dr. Dowling made several strong recommendations about ways we might proceed, and he served as one of the evaluators. Dowling's report is the third chapter of this monograph.

THE EVALUATION PLAN

In adhering to as much of Stakes' philosophy as possible, Del Mod felt that the most honest means of presenting itself to the education community might be to assess itself as an end product of an evolving program.

Assessment of pre-conditions, formative data, measurement of goals and objectives, and pre-post comparisons were all possible, and some are being utilized in various other efforts to describe Del Mod. It is important to stress that this evaluation is only one of several projects to describe the Del Mod System which will be published in 1976.

The evaluation began with the selection of individuals to examine Del Mod as it currently exists. Each of the components

of the System agreed to the plan and each selected a number of the on-site evaluators who participated. Thus, the President, the Dean of the School of Education, and the Del Mod Component Coordinator of the University of Delaware were each asked to recommend individuals who would participate in the evaluation. The Department of Public Instruction selected five evaluators in a similar fashion, two of whom were experts in mathematics education.

Delaware State College and Delaware Technical and Community College each invited three evaluators, and the Del Mod office added the names of experts in evaluation and the names of four Delaware teachers. Two of these teachers taught science and two taught mathematics, and each was recommended to the Del Mod office by field agents who had worked with them.[1]

The selection procedure introduces obvious sources of bias. For the host institutions to choose advocates to represent various personnel or programs within those institutions, and then report directly to that host can be assailed. The Del Mod position on such criticism is two-fold: any evaluation can be characterized as biased on the above grounds, but the total evaluation summary as prepared by Dr. Humphreys would tend to wash out any bias specific to an institution.

A further hedge against bias was attempted by the Del Mod Research Director. Each evaluator was personally oriented to his task and reminded of the statewide nature of the Del Mod System prior to the evaluation period. The evaluators were urged to be as unbiased as possible and to be frank in their written reports.

The evaluators were scheduled to spend two days in Delaware schools and in Del Mod components as part of their effort to analyze Del Mod. No stipends were paid, but all of these people received remuneration for their actual expenses.

As part of their instructions, the evaluators were asked to read several background papers prior to visiting Del Mod, and each was asked to act as an agent for the individual who sponsored them as an evaluator. For example, the evaluator nominated by the State Superintendent of Schools was asked to prepare a report focusing on Del Mod's relationship with the Department of Public Instruction.

Not only was each evaluator asked to examine his host component, but each was asked to observe relationships with other institutions and with Del Mod activities conducted at resource centers and by field agents. The evaluators mailed their conclusions directly to their host component, from where they were forwarded to the Del Mod office.

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[1] Of the total number of invited evaluators, 19 accepted. Subsequently, two never submitted their reports.

Among other considerations, was the desire on the part of the Research Director that each evaluator perform independently. Yet, on two occasions, evaluators worked in pairs and the result was that there was an undesired pooling of conclusions.

VALIDATION OF THE PROCESS

When all of the papers had been received, Del Mod employed Dr. Donald Humphreys of Temple University to read, summarize, and draw conclusions from them. Since Dr. Humphreys had never been involved in any way with Del Mod during its history, we felt he would be in a good position to be objective about the entire process.

There are many accepted means of doing an evaluation which must stand a rigorous inspection by the academic community. This evaluation will have to withstand such inspection. There is as yet no generally accepted sentiment for Stake's theories on responsive evaluation though Stake himself is regarded as an outstanding evaluator by his peers. Questions such as "Did Del Mod meet its objectives?" cannot be answered by this type of effort. Rather, the question of "What is Del Mod?" is asked, and the responses must stand a test of their own. If the consensus of evaluators seems to be positive about some aspect of Del Mod, then that aspect might be worth attempting elsewhere.

The essence of Del Mod's responsive evaluation consisted of satisfying NSF requirements for information by asking experts to comment about what was worthwhile and transportable of the many Del Mod functions. To the extent that the experts agree in their descriptions of such functions, the evaluation is or is not a success.

Dr. Kenneth Dowling was asked to examine the outcome and the process of the evaluation to determine whether it was valid. His analysis of the procedures and outcomes of the evaluation is an important touchstone in the future acceptance or non-acceptance of the theory of responsive evaluation, particularly as it pertains to projects similar to Del Mod. Included after the Humphreys and Dowling reports, there are several conclusions and recommendations. The reader should note that there are other evaluations of Del Mod System activities which can supplement the findings of this study. Responsive evaluation, in this instance, is employed to present a total picture of the Del Mod System as it exists in its final form. In-depth descriptions of certain aspects of Del Mod are listed in Appendix B.

Chapter Two

EVALUATION OUTCOMES

Donald W. Humphreys
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EVALUATION OUTCOMES
Chapter Two

Introduction There is little question about the importance of program evaluation, but there is some disagreement among evaluators as to what constitutes valid evaluation. The statistical models of evaluation have provided researchers and evaluators with some degree of satisfaction as to whether an experimental activity or a change in the teaching mode have caused a change in pupil achievement or not. The numerical assessment provides a concreteness to the research not available from other evaluation models. The danger inherent in some statistical assessments is in stressing numerical precision where numerical precision is unwarranted. It also is evident that descriptive evaluations may allow evaluators to express different weights of importance of components of a program. Conversely, the descriptive evaluation lacks numerical precision. It is the state of the art which should determine whether a statistical or a descriptive evaluation model should be used.

Several of the seventeen evaluators of the Del Mod Project expressed concern about the method of evaluation used. These evaluators felt that a precise numerical evaluation should have been used. For the final evaluation of Del Mod, both descriptive and statistical evaluation have been used. This report is a summary of the descriptive evaluation of the Del Mod System. If compiled properly, the combination of statistical and descriptive evaluation should provide a relatively complete assay of the Del Mod System activities. (See Responsive Evaluation, Appendix A).

The Evaluation Team The evaluation team members were asked to participate in the evaluation by the Delaware Department of Public Instruction, The University of Delaware, or the Del Mod System. Two evaluators usually evaluated Del Mod on the same dates, but each operated independently, following a flexible pre-determined schedule. No attempt was made to invite the evaluators on the same dates, but pairings often resulted coincidentally when the Del Mod staff schedules were matched to the schedule of each evaluator. To be certain that the desired components were evaluated, each evaluator was asked to emphasize either the Del Mod administration, resource centers, field agents, or evaluation as the evaluation task. In all cases the evaluators were asked to determine the transportability of any or all of the Del Mod components. Each evaluator had contact with the resource centers, Del Mod administration, Del Mod

evaluation staff, and field agents during the two day evaluation period. See Appendix C for listing of evaluators.

The Responsive Evaluation of the Del Mod System The Del Mod System has been in operation since 1970. Sponsored by the National Science Foundation and assisted by the DuPont Company and the State of Delaware, the Del Mod System was designed to provide the science and mathematics teachers of Delaware with direct assistance through curriculum workshops, field agent and resource center assistance, and solution to individual teacher classroom problems. The Project will have completed its obligation to the National Science Foundation in July, 1976; and if parts of the project are to continue, funds must be provided through other sources.

This report will summarize the findings of the invited evaluators under the headings of (1) Del Mod System Administration, (2) Mathematics and Science Field Agents, (3) Science and Mathematics Resource Centers, (4) Equipment Repair Center, and (5) Evaluation Staff.

Del Mod System Administration The administrative structure of the Del Mod System is unusual in its governance by representatives from the University of Delaware, Delaware State College, Delaware Technical and Community College, the State Department of Public Instruction, and the Del Mod System. A Council of Presidents was composed of the chief officers from each of the institutions listed above. The Council of Presidents delegated fiscal authority to a Council of Deans but retained the policy making function. The director of the Del Mod System retained major responsibility for fiscal management and the implementation of policy and program.

It was evident that a policy existed to disseminate as much of the funding as possible directly to the Delaware teachers. An estimated 78% was spent on teacher workshops, special teacher projects, the resource materials, and classroom assistance through the field agents.

Little feedback from Delaware teachers was available to evaluate the administration of Del Mod. Teachers had little direct contact with the Del Mod administrators and were generally unaware of the administrative structure. Based upon the general teacher satisfaction with the Del Mod System, it can be assumed that administrative structure was adequate and worked well.

Different evaluators noted the excellent liaison between the Department of Public Instruction, Del Mod, the University of Delaware, Delaware State College, and Delaware Technical and

Community College. One evaluator perceived a desire by administrators of the institutions of higher learning to upgrade science education in the State of Delaware. Evaluators also perceived the support of the field agents by the Del Mod administrators.

One evaluator noted that the administrative model was flexible enough to meet the needs of participants in the program and that the funding of the program was administered well.

Evaluators involved in evaluating the Del Mod Administration generally were highly favorable to the administrative function and structure, but felt that the administrative model would not adapt itself well to other states developing similar programs. To say the administrative model of the Del Mod System is not transportable to other states does not imply that the administration of Del Mod was ineffective. The relatively small area served by Del Mod when compared to the area of most other states, and the number and location of institutions of higher learning in other states would probably dictate the structuring of a different administrative model.

Field Agents Of the several components of the Del Mod System, teachers have viewed the field agents as the most important facet to them. This result is not surprising since the field agents were envisioned originally as the direct link between the Del Mod goals and the teachers.

The field agents were well suited for their positions. Each was required to have earned a baccalaureate in science and a master degree in science education, and to have completed five years of successful classroom teaching in grades 5-9. Each brought to Del Mod a unique set of experiences and skills which were augmented by attendance at national meetings and workshops designed to promote understanding of the rationale of new science curricula.

Several goals have been built into the field agent component of the Del Mod System. They are listed as follows:

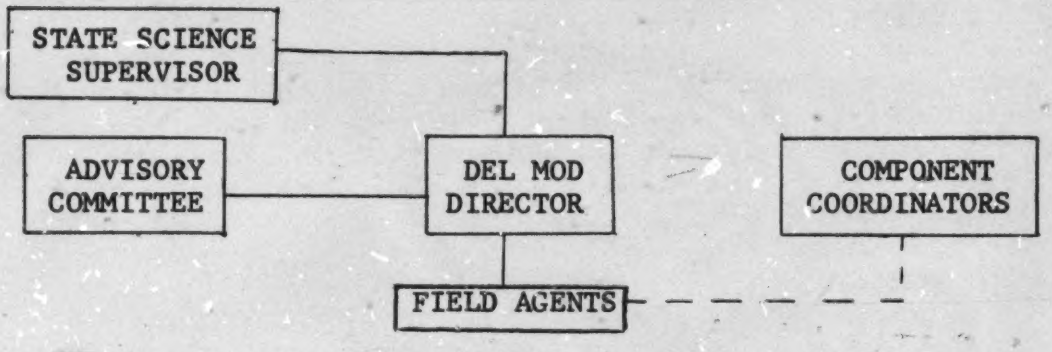
(1) Establish liaison between the institutions of higher education, research centers, curriculum projects, state agencies, and the classroom teacher within designated levels and geographic areas.

(2) Construct, adapt or utilize any techniques needed to improve teacher competencies.

(3) Conduct a wide variety of inservice activities designed to meet the needs of science teachers as determined by baseline data, conferences with local supervisors, the state science supervisor, teachers and others.

(4) Disseminate information about and serve as implementors

for materials and methods developed by curriculum projects of the Del Mod System and other institutions.



Field Agent Relationships
Figure 1

The Director of Del Mod was responsible for supervision of the fiscal and policy operations of the field agents until fiscal year 1974-1975 when the component coordinators assumed this function. This change was part of a planned change in administrative structure after NSF funding stopped. An advisory committee reviewed the program, while the component coordinators and the state science supervisor provided some direct input for special curriculum projects.

Each field agent worked out of a resource center and had available the latest science and math teaching materials for Delaware teacher use.

The original operational philosophy for the field agents was followed closely by the field agents; from the feedback provided to the evaluation team, this guide to field agents was instrumental to the high degree of success for the field agent component of Del Mod. The philosophy statement ends with the sentence: "It is construed to involve liaison between all segments of the industrial, scientific, educational communities, and classroom teachers in a non-threatening manner." The most frequently made statement to the evaluation team by teachers was that they could speak freely about classroom problems without fear of being poorly evaluated by a supervisor. They could honestly seek help with classroom problems which could lead to improved science and math teaching.

All evaluators evaluating the field agent component of Del Mod stated that this was the most important part of the system. Schools using the services of field agents have become dependent

upon the use of their services and would like the program continued. This dependence in part may be due to the fact that many services provided had previously been unavailable to the schools.

Several evaluators found that new curricula were introduced to teachers by the field agents, or that teachers were stimulated to investigate existing curricula, or encouraged to develop a unique curriculum for their school. In addition to the curricula developments, teachers were encouraged to develop individual projects involving new instructional technique, development of equipment, and other classroom innovative practices.

The field agents were lauded for their ability to sense teacher needs and to provide inservice programs for each need. Evaluators differed on the effectiveness of these programs. Two evaluators felt that more effort should have been put into long-range planning while others felt that the curricula developed did represent long-range planning. It appears from the evaluator reports that field agents were most interested in the immediate needs of the teachers. The teachers were most interested in the solution of immediate problems and took only secondary interest in long term goals. The long-term planning was probably incidental to the more pressing immediate problems. It is apparent, however, that long-term planning is generally built into most curriculum projects.

The field agents were able to provide teachers with concrete examples of many instructional and curricular innovations since these materials were readily available in the three resource centers. None of the evaluators questioned the value of the centers to the schools, but many felt that the most important aspects of the field agents' work did not involve the resource centers, and that if no resource centers were available, the field agents could still operate successfully.

Several evaluators like the flexibility of the individual field agents. Each was apparently able to provide assistance in a wide variety of problem situations. One evaluator noted that the field agents were most effective when teachers asked them to perform specific tasks, or to solve specific problems.

The evaluators rated the field agent concept as transportable to other states. Several different variations were suggested for implementation into different geographical areas. One evaluator suggested that two field agents could work out of each community college. Several evaluators pointed out that since universities and 4-year colleges have a somewhat different staff advancement structure than does the community college or other agencies, that the strong service aspect of the field

agents' position would best be administered by the community college or a service-oriented agency. Another evaluator suggested that the field agents could work out of the various state departments of public instruction. Units similar to the intermediate units of Iowa and Michigan were suggested as a third alternative to a field agent program. The fourth alternative would have a single field agent hired by several school districts, with the agent's time spent in any one district being determined by the percentage of his salary paid by that district.

Several evaluators would like to see minimal secretarial help provided for the field agents. This would enable them to naintain a schedule and to have appointments phoned in from the schools.

The teacher reaction to the field agent component of Del Mod was highly positive. Since it is the most visible component of Del Mod to the teachers and since the field agents supplied rapid solutions to the classroom teacher problems, their activities were evaluated by teachers as the most important part of the Del Mod Program.

To gain the confidence that teachers held for the field agents, it was necessary for the field agents to demonstrate that they had no vested interests in the Department of Public Instruction, institutions of higher learning, or public school administrations. The field agents were there to help teachers and not to evaluate them. The trust thus generated allowed a rapport between field agents and teachers to exist that enabled honest problem solving in the classroom to take place. One teacher described the field agents as "doers at the grassroot level."

Since the field agent program has been instituted, the agents have worked with 89 schools while conducting 127 workshops, participating in 20 curriculum projects, directing 15 courses, developing an outdoor classroom, and implementing an individualized instruction program.

The field agents have maintained a high professional level of competence. The agents belong collectively to 13 local, 8 state, and 2 regional professional committees. They have produced numerous publications and a periodic newsletter for the teachers of Delaware. They have presented papers at six local, six regional, and three national conventions.

Perhaps the most important attribute of the field agents was the teacher confidence they created. They not only provided materials, but psychological support as well. They were viewed by teachers as a supportive friend.

Science-Math Resource Centers Success of elementary and secondary school science and math programs are often dependent on a teacher's ability to provide a variety of learning environments. The adequate amount of learning vehicles are not available to most schools, either because the teachers and administrators do not know about them or the budget of the school does not permit purchase of such items. The Del Mod System established the science-math resource centers to provide both preservice and inservice teaching devices, models, and texts.

Specifically, the resource centers allowed teachers to borrow or to examine materials and equipment, textbooks, films and other audio-visual equipment. Science supervisors, teachers, science groups, or preservice teachers could use the centers as a locus for program development projects. The field agents could use the equipment of the center for demonstrational teaching or for teacher use, and used the center as an operational base.

Three centers were established in the Del Mod System. Although each was set up under the same guidelines, the location of each ultimately dictated different functions. Centers were located at the University of Delaware at Newark, Delaware State College at Dover, and Delaware Technical and Community College at Georgetown. Each center served inservice and preservice teachers, but to different degrees. The Georgetown Center served primarily inservice teachers and was consequently rated highest by teachers interviewed during the evaluation. The University of Delaware and Delaware State College have science education programs for undergraduate students; consequently, the centers at Dover and Newark were used heavily by the preservice teachers. Inservice teachers had difficulty finding adequate parking facilities at the University of Delaware and consequently did not use the center as frequently as it was anticipated they would. The University of Delaware center, however, was useful to the inservice teachers through the services of the field agents. The center at Delaware State College was least useful to the inservice teachers since it lacked some materials found in the other centers and was apparently less well organized. The Dover Center librarian has duties outside the center which removed some of the service function found in the other two centers.

The evaluators involved with resource center evaluation all viewed them as a valuable asset to the Del Mod System. They also found the resource center idea would be transportable to their locales. The Georgetown Center model was the one most transportable. This center was not directly associated with a teacher training program and therefore gave its full commit-

ment to inservice teachers. It also had a wide range and scope of materials. One evaluator suggested that the center would be most useful in the intermediate unit concept of Iowa and Michigan. Another evaluator believed the Georgetown model could be moved intact to a community college setting. Several evaluators indicated that construction of instructional materials was a useful and transportable item used by the centers. The field agents should be tied more directly to the centers. In the Del Mod System some field agents used the centers more effectively than others.

When selecting a site for a resource center the target population must be kept in mind. It was fortunate that the Del Mod System had an opportunity to set up a center in primarily a graduate student, preservice teacher setting (Newark), an inservice teacher setting(Georgetown), and a preservice setting (Dover). Most evaluators favored the inservice-teacher-only center model and would, therefore, like the center established in a 2-year college or intermediate unit setting. The use of senior citizens was viewed by some evaluators as an effective use of funds and an idea that would be transportable to their areas. The center should be large enough to require the use of a full-time librarian.

The flexibility component of the Georgetown center is an important attribute. The center must be able to meet a teacher's needs immediately in order to be highly effective. This includes workshops and inservice programs requested by teachers.

Where initial funds for a resource center are limited, a director could collect a variety of materials from several schools and then consolidate the material into a small center. The center could be made larger as more funds became available.

The newsletter published by the Georgetown Center is a transportable item as viewed by most evaluators.

Although most evaluators believe the resource centers are most effectively used for inservice teachers, there is little question that the centers were valuable to preservice teachers as well. It is quite possible that centers such as the ones at Dover and Newark could be set up equally well in other 4-year colleges and universities.

The Equipment Repair Center The Equipment Repair Center was unheralded, but viewed as an important asset to the Del Mod System. This "behind the scene" operation provided schools with equipment repair service for microscopes and other scientific equipment on a parts cost basis. The repair work was done by students in the Technical College. A service was not only provided for teachers, but for the Technical School students

as well. The repair service is unique and is transportable to the degree that similar technical schools are found throughout the United States. It appears that they would welcome materials suitable for student use in a technical school program. One evaluator recommends that adequate funding ($25,000) should be made available to make transportability feasible.

Del Mod Evaluation Staff The philosophy of Del Mod was to place a high percentage of the funding for the program directly into the schools through the various service components available for school use. As a result of this philosophy, the non-service component of evaluation was not funded as well as is true for most NSF sponsored programs. The five percent of the funding allocated to evaluation was, in retrospect, inadequate.

In spite of the program directional changes due to key personnel changes during the five year history of Del Mod, and goal modifications necessary due to pragmatic policy changes, an evaluation program was conducted by the evaluation staff.

Formative evaluation was conducted through the research of science education doctoral students from Temple University and Lehigh University, and through annual summary reports submitted by Del Mod each year to NSF.

Summative evaluation has been conducted by the evaluation staff for the past year on the various components of Del Mod. In addition, the Responsive Evaluation adaptation originally developed by Robert Stake (see appendix A) was used to measure the effectiveness of the several components of Del Mod.

Global Summary of the Del Mod System The reports by the panel of evaluators were highly favorable to the Del Mod System. The administrative component of Del Mod was effective in the Delaware setting. Evaluators generally felt that the administrative component would not be transportable since the structure in different locales vary sufficiently to require a unique administrative model for each locale.

The field agent component was the most valuable part of the Del Mod System. As a major goal of Del Mod, the money from the project should end up in the schools of Delaware in the form of improved science and math teaching. The field agents made this possible. Generally the field agent was regarded as a well qualified expert in science or math that posed no threat to the security of the teacher and who not only helped, but befriended the teachers. The field agent component was the most transportable to other parts of the United States.

The Science-Math Resource Centers were also viewed as an

integral and important part of the Del Mod System. There was some disagreement as to whether the field agents could operate effectively without the resource centers, but all evaluators viewed the resource center model as transportable to other parts of the United States.

The Equipment Repair Center is valuable not only to the teachers using the service, but to the technical students doing the repair work. This component is transportable as long as properly located technical colleges are available.

Some evaluators felt uncomfortable using the Responsive Evaluation technique as the vehicle to evaluate Del Mod. It is interesting that in spite of the concerns of some, there was a great deal of consensus among evaluators about both the positive and the negative aspects of the Del Mod System. Particularly strong agreement was registered by evaluators on the effectiveness of the field agents and of the resource centers.

The evaluators generally agreed that teachers using the services provided by Del Mod had become dependent upon them. If the apparent improvements are to continue, and if present levels of science and math teaching in Delaware are to be maintained, the program of field agents and probably of resource centers must continue. Although the funding required for continuation of the Del Mod Project would be high, the budget would be significantly lower than the initial operational costs. The upgrading of each resource center annually would be nominal when compared to the salaries paid to the field agents and resource center librarians.

Chapter Three

VALIDATION OF THE DEL MOD RESPONSIVE EVALUATION PROCESS

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VALIDATION OF THE DEL MOD RESPONSIVE EVALUATION PROCESS
Chapter Three

In order to understand and accept the unique responsive evaluation design used by the Del Mod Project, it is necessary to first understand something of the nature of the Del Mod Project itself. Del Mod was one of the first of the systems projects funded by the National Science Foundation. Because of successful initial experiences, Del Mod led to the more generalized and broader comprehensive projects. Del Mod was established primarily to provide services in science and mathematics to the school systems of the State of Delaware. Initially, it was perceived that these services would be described in terms of curriculum implementation and inservice education of teachers. However, the objectives of the project had to be described in a very general way in order to allow sufficient latitude to the project to make it possible for the staff to provide for the needs that would be identified through local research within the systems being serviced.

The original objectives of the Del Mod Project were:

- To provide resource centers;
- To provide field agents as translators of theory into action;
- To provide academic expertise to school systems through colleges and universities for extension of learning stimulated by field agents (i.e., course work for inservice teachers);
- To provide appropriate undergraduate experience in science and mathematics at Delaware State College;
- To provide teachers with experience in environmental education;
- To incorporate mathematics into science; and
- To provide a dissemination network for science.

From the beginning the model for conducting the business of the project was based upon a stimulus-response sequence for action taken to move toward project goals.

Del Mod was, from the beginning, intended to be a pragmatic rather than a theoretical or experimental program. Where educational needs in science and mathematics could be identified, the program design had to be altered to meet those needs. During the period in which the project operated, many new services were introduced while those efforts that had proved to be nonproductive were dropped. Because of this ongoing evolution of the entire project, a summative evaluation on the basis of

initial objectives was not appropriate.

In practice, evolution of the project was not dependent entirely upon identification of local school district needs. The administrative structure of the project provided for input at three levels from four major educational components in the state. These are the Delaware Department of Public Instruction, the University of Delaware, Delaware State College, and the Delaware Technical and Community College. Each of these components has a vested interest in the relative success of the state's educational programs. However, identified responsibilities of the components are not the same and as a result the need to use Del Mod resources for functions such as preservice education of teachers tended to be a distraction from the more direct initial purpose of the project -- to provide services to local school districts. The resulting stress on the project objectives has been instrumental in making it necessary to evaluate ultimate outcomes on the basis of identification of the positive contributions that have been made.

Another factor affecting the decision to do a subjective evaluation was the fact that the initial proposal did not provide for project evaluation. Although a research director was appointed, his identified responsibility was to do research for the System itself and to provide data that could be used to interpret statewide needs for determination of future project direction. It was only as the project approached its conclusion that a requirement for overall evaluation was introduced. As a result, opportunities to gather data that would be important to an objective evaluation were bypassed. In retrospect, it has been stated that there should have been an ongoing evaluation of the degree of achievement of the intents and purposes of the entire project regardless of the apparent importance of such evaluation. The initial project design did not call for it. It was, therefore, necessary to devise an evaluation plan that could best serve under the existing circumstances.

It should be noted that this evaluation design was affected by a prior attempt at objective evaluation done by highly skilled outside evaluators. It was unfortunate that this effort, which had to be conducted without observations that could have been made throughout the duration of the project, indicated that there had been lack of success in achieving certain objectives even though consumers of project services generally agreed that there had been a high degree of

success and that Del Mod involvement had been beneficial to educational programs.

The design for this evaluation followed a responsive format which was dependent upon descriptions written by Robert E. Stake of the University of Illinois. In writing about responsive evaluation, Stake has provided the following description:

> An educational evaluation is a responsive evaluation if it orients more directly to program activities than to program intents, if it responds to audience requirements for information, and if the different value perspectives present are referred to in reporting the success of the program. In these three separate ways an evaluation plan can be responsive.[1]

As Stake describes this type of evaluation, it is the role of the evaluator to make pertinent observations concerning previously identifiable components within an educational system. Where the evaluation is summative, as this evaluation is, such a procedure will be particularly useful "when audiences want an understanding of the activities and of the strengths and shortcomings of the program. The responsive evaluator may see his responsibility as indirectly providing a shared experience, one that the audience cannot directly share for one reason or another." In defending this concept of evaluation Stake has described it as a defense against oversimplification that has been a fault of evaluators who "use research data to argue a point."[2]

Since this evaluation has not been based upon pre-conceived objectives, it follows in essence the goal-free evaluation that has been described by Michael Scriven. In writing about goal-free evaluation, Scriven has said,

> It seemed to me, in short, that consideration and evaluation of goals was an unnecessary but also possibly contaminating step. I began to work on an alternative approach -- simply the evaluation of actual effects against (typically) a profile of demonstrated needs in this region of education.

He also wrote, "Goal-free evaluation is unaffected by, and hence does not legislate against, the shifting of goals midway in a project. Given the amount of resentment caused by

evaluation designs that require rigidity of the treatment throughout, this is an important benefit."[3] Both Stake and Scriven have insisted that although prior objectives are not to be evaluated, there must be structure in the procedure by which the evaluation is to be conducted. This idea has been amplified in a system referred to as theory-based evaluation by Fitz-Gibbon and Morris.[4] In this evaluation, the precise structure of the Del Mod System is sufficient to formalize the procedures of observation so that the overall Del Mod format could be considered the theory and the components of the Del Mod administrative model as well as the specific activities such as field agents, resource centers, and special projects, could be the variables upon which observations can be made. In actual practice, the component functions were informally broken down by evaluators to suit their observations. Although this practice resulted in divergent comments, it had the effect of providing great latitude to evaluators in responding to what they believed their particular audience wanted.

The procedure for conducting the evaluation consisted of selection of individual evaluators, spending, prior materials, on-site visits, and reporting. Nineteen individual evaluators were selected. To accomplish this, each of the four components of the project were given the opportunity to select their own evaluators. Through this process, the Delaware Department of Public Instruction invited six individuals, the University of Delaware invited three, Delaware State College invited two, and the Delaware Technical and Community College invited two. In addition, the Del Mod staff invited two evaluators and the field agents who had greatest contact with public school personnel invited four. The latter were teachers who had experience with the project. Each of these 19 individuals was judged by the component arranging for participation to have expertise that would qualify them to evaluate the overall project in general and the involvement of the component in particular.

Each of the evaluators received, by mail, a set of materials designed to acquaint them with the nature of the project prior to their visit. This packet included samples of monographs that had been published by the project during its duration and other related documents. Essential to this material was a paper entitled "Del Mod Responsive Evaluation Project: Overview of the Del Mod System." This paper provided a background of the project including the nature of the state of Delaware, the organization of public schools in the state, a brief history of the Del Mod System, and a description of the

Del Mod structure including information about staff, funding, special projects, and publications. A summary of this paper explained the reasons for the evaluation that was being conducted. Also included with these materials was a brief paper by Robert E. Stake explaining the nature of responsive evaluation with recommendations for procedures that would provide necessary structure to observations and corresponding reports.

Each evaluator worked independently in making on-site observations of the Del Mod System. In order to standardize procedure, each evaluator was first introduced to the Del Mod System through an interview with the project research director. At this time direction for conducting the evaluation was given through a procedure that was as standardized as possible in order to avoid biasing evaluators. At this interview the evaluator was given a set of materials entitled "Del Mod Responsive Evaluation Project Handbook." This handbook consisted primarily of identified issues related to the Del Mod System as a whole, to the component coordinators, to the field agents, to the resource centers, to the science instrument repair center, and to individual teacher projects. The evaluator was asked to consider these issues in light of a criterion of overall worth and transportability of the Del Mod activity being observed.

Once the introductory interview was completed, the evaluator was provided transportation by a member of the Del Mod staff to the sites where activities of interest to the evaluator were being, or had been, conducted. In each case the evaluator was introduced to key personnel who had been involved in the Del Mod activity under consideration. However, during the time that the evaluator interviewed the key person or persons the Del Mod staff member was not present. This provided the evaluator with complete freedom in asking pertinent questions and in making observations of equipment, materials and facilities involved in the activity. Although, according to the design, each evaluator was assigned to specific sites for making observations, the overall coverage was complete since the number of evaluators was sufficient to provide repetitive observations in all areas. This, incidentally, caused some concern on the part of the part of evaluators who did not have the opportunity to select sites they would visit nor to have a comprehensive view of the entire project. It did not, however, provide any observable bias to the final summary report.

Once the observations were completed, the evaluator was instructed to complete a written narrative report and submit it

to the Del Mod Research Director to be compiled with others for use in the development of a summary report by Dr. Donald Humphreys who had no previous involvement with the Del Mod Project nor any knowledge of Del Mod staff members or their activities. Dr. Humphreys was selected as a person who could be completely unbiased in interpreting what the Del Mod evaluators had written.

The effort at responsive evaluation of the Del Mod Project has provided a valid identification of those major activities of the project which were both worthwhile and considered to be transportable to other projects in other areas of the country. In some cases, the unique characteristics of the state of Delaware and the administrative structure in which the Del Mod Project had to operate made it apparent to evaluators that for transportability to be feasible, considerable change in the model would be necessary. For the most part, the summary report does a good job of describing the positive characteristics of the project and provides suitable answers to questions that might be raised by those interested in adapting Del Mod ideas to other situations. The summary report will not be particularly helpful to those who are concerned with what might be called the fine structure of the project outcomes. It is apparent from talking to district personnel and others who have participated with the Del Mod Project that Del Mod contributed to many significant, but often minor, changes in science and mathematics education in the districts of the state. In addition, there was considerable individual motivation at all levels in the administrative and teaching structure that must be considered as a positive outcome. However, because of the nature of the evaluation design and the basic issues that the evaluators were asked to consider, this kind of detail, if it appears at all, is found only in the individual reports and has not been used in developing the summary. This does not detract from the validity of the evaluation effort but those using the report should realize that identification of all of the positive aspects of the project would require further investigation. It should be observed that those activities of the project that had negative results are not described in the report. This, of course, was not the intent of the evaluation. However, readers of the report should be cautious in inferring that those activities of the project components that are not identified as worthwhile and transportable have, therefore, had negative results. Such activities may have very well been worthwhile within the boundaries of the project but were not considered to be valuable outside the context of the Delaware school system.

The evaluation effort has been successful in providing a good subjective description of the positive project outcomes. When taken with other descriptive material produced during the period in which the project has been in operation, the evaluation is very useful in determining whether or not such efforts have application in the future.

REFERENCES

1. Stake, Robert E., "Responsive Evaluation," a paper written at the University of Illinois, December 5, 1972.

2. _____, Educational Forum, "Comments and Conjectures," pages 271-272, January, 1972.

3. Popham, W. James, Editor, Evaluation in Education, "Evaluation Perspectives and Procedures," Michael Scriven, McCutchin Publishing Company, Berkeley, California, 1974.

4. Fitz-Gibbon, Carol T. and L.L. Morris, Journal of Education Evaluation, "Theory-Based Evaluation," Evaluation Comment, Center for the Study of Evaluation, UCLA, Los Angeles, California, June 1975.

Chapter Four

CONCLUSIONS

John R. Bolig
Research Director
The Del Mod System

CONCLUSIONS

CHAPTER FOUR

It would be presumptious to summarize the previous two chapters since each is, in effect, a summary itself. The question of whether the evaluation functioned properly and was effective has been more than adequately covered by Dr. Dowling. The answer in each case is affirmative.

The question of Del Mod's having been worthwhile is answered by Dr. Humphreys, and again the answer is affirmative. The question of transportability of various Del Mod activities is also addressed by Dr. Humphreys. The answer in these cases is conditional. The activities which are worth attempting elsewhere would have to be reasonably well funded and a set of other conditions would have to exist to insure their success. These qualifications are described in some detail.

An apology is probably due to Dr. Stake. Del Mod's implementation of his design for responsive evaluation may not have been as rigorous as he described, but this evaluation was stimulated by his paper (appendix A). As with all Del Mod projects, an evolution was evident between the time the evaluation was first proposed and the time it was approved as a plan of execution. The compromises which were made were necessary and appropriate.

Cost of the Evaluation. The total cost of this evaluation was about $3500.00. The figure is inclusive of all possible costs from the planning stage to the printing of the final document. The return on the investment in terms of the quality and quantity of the various documents produced vastly exceeded Del Mod's expectations. In comparison to the actual or projected costs of other external evaluations which were carried out or which were proposed for Del Mod, this has been the evaluation bargain of the past six years, and the quality can not be denied.

The Individual Reports. The seventeen reports produced by the evaluators and summarized by Dr. Humphreys are preserved and will be stored at the University of Delaware. Each of the evaluators listed in Appendix C might also be called upon if copies are required.

RECOMMENDATIONS

Del Mod was an experiment and several aspects of the experiment were worthwhile and transportable. Dr. Humphreys' assessment of those which were worthwhile and his conditions for their transportability are reported in Chapter Two. The

field agent concept, and the Del Mod approach to establishing and managing resource centers seem to meet these tests.

It would be difficult to develop more than a general knowledge of Del Mod from this report, but the reader is directed to other volumes of Del Mod's final evaluation for indepth studies of facets of the system. Separate volumes have been prepared to describe field agents and resource centers.

One recommendation which must be seriously considered if a systems approach is to reach its potential would be the establishment of a permanent evaluation team external to the administration of the system. It must also be adequately funded. Del Mod's most obvious flaw was created as the result of oversights by the people who should have known better.

During Del Mod's first four years, only two people, Dr. Robert Uffelman and this writer, were calling for evaluation of the system. Mrs. Purnell, Del Mod Director, and Dr. Pratt of the duPont Company made great efforts to support these appeals, but Del Mod had been created without any mechanism to evaluate, and adding a mechanism without money or intellectual committment met with stiff resistance.

In the last two years of Del Mod's existance, the Dean of the School of Education at the University of Delaware, Dr. Daniel Neale, became very supportative of evaluation efforts, and much of the final product is due to his leadership. Any attempt to conduct a systems approach will require someone of Dr. Neale's integrity and strength if evaluation efforts are honestly undertaken.

Appendix A

RESPONSIVE EVALUATION

by

Robert Stake

Robert E. Stake
December 5, 1972

RESPONSIVE EVALUATION

Most contemporary plans for the evaluation of educational programs are "preordinate." They rely on prespecification. They emphasize (1) statement of goals, (2) use of objective tests, (3) standards held by program personnel, and (4) research-type reports. It is even presumed by some that these are essential features of any evaluation plan. They are not. There is an important alternative to preordinate evaluation: responsive evaluation.

This is not a new alternative. Responsive evaluation is what people do naturally in evaluating things. They observe and react. What is new is the beginning of a technology developed around this natural behavior, in part to overcome its defects.

An educational evaluation is a "responsive evaluation" if it orients more directly to program activities than to program intents, if it responds to audience requirements for information, and if the different value-perspectives present are referred to in reporting the success of the program. In these three separate ways an evaluation plan can be responsive.

An evaluator is employed by a client to do an evaluation, with certain audiences in mind. To do a responsive evaluation, the evaluator conceives of a plan of observations and negotiations. He arranges for various persons to observe the program. With their help he prepares brief narratives, portrayals, product displays, graphs, etc. He finds out what of that is of value to his audience. He gathers expressions of worth from various points of view. Of course, he checks on the quality of his records. He gets program personnel to react to the accuracy of his portrayals. He gets authority figures to react to the importance of various findings. He gets audience members to react to the relevance of his findings. He does much of this informally, iterating--keeping a record of actions and reactions. He chooses media accessible to him and his audiences to increase the likelihood and fidelity of communication. He might prepare a final written report, he might not--depending on what he and his client have agreed on.

Structures

Responsive evaluations require planning and structure; but they rely little on formal statements and abstract representations, e.g., flow charts, test scores. Statements of objectives, hypotheses, test batteries, teaching syllabi are, of course, given primary attention if they are primary components of the instructional program. Then they are treated not as the basis for the evaluation plan but as components of the instructional plan. These components are to be evaluated just as other components are.

Tests and other data-gathering devices are not ruled out. The choice of these instruments is made as a result of observing the program in action and of interacting with various groups having an interest in the program.

The proper amount of structure for responsive evaluation depends on the program and persons involved. There is a need to plan and interact naturalistically. Too much and too little planning are both bad. Too much and too little prose representation are both bad. The structure should serve the purposes of the evaluation--in preordinate evaluation, structure sometimes dictates purpose.

Utilities

Responsive evaluation will be particularly useful during formative evaluation when the project staff needs help in monitoring the program and when no one is sure what problems will arise. It will be particularly useful in summative evaluation when audiences want an understanding of the activities and of the strengths and shortcomings of the program. The responsive evaluator may see his responsibility as indirectly providing a "shared experience," one that the audience cannot directly share for one reason or another.

Preordinate evaluation should be preferred to responsive evaluation when it is important to know if certain goals have been reached, if certain promises have been kept, and when certain hypotheses or issues are to be investigated. With the greater focus and opportunity for preparation, measurements made can be expected to be more objective and reliable. To the extent that aims or issues change, the preordinate approach may be less desirable.

There are many reasons why preordinate evaluation can be ineffective. It is likely to be underfunded, understaffed, and initiated too late. But even under optimum conditions it often will fail. A collection of specific objectives will understate educational purposes. Different people have different purposes. Side effects--good ones and bad--get ignored. Program background, conditions, transactions are likely to be poorly described. Standardized tests seldom match objectives, criterion referenced tests oversimplify and fail to measure transfer, and custom-built tests are poorly validated. And people cannot read many of the reports or do not find them useful.

Responsive evaluation is not likely to overcome all of these obstacles. But it is an approach that is attentive to them. There are problems with the responsive approach too. Not enough time or resources may be available to measure key outcomes. The results may be seen as too subjective. The assets and liabilities of the two approaches need to be weighed before and during an evaluation study.

S - R Differences

Probably because of his ties with the experimental psychologist, the preordinate evaluator has dealt himself a substantial responsibility for providing a standardized stimulus (e.g., behavioral objective, test item). The whole evaluation project is treated as a "stimulus" to which the teachers or students will respond, and their responses will constitute an evaluation report.

Confident in his ability to comprehend and operationalize purposes, this evaluator defines his role as one of arranging a stimulus condition (or taking advantage of an existing one) which evokes a critical performance. He records the performance objectively so as to demonstrate the effects of the instructional program.

The success of his efforts depends not only on whether or not he can devise stimuli having "criterion" value, but on his ability to report them in a useful way. He often seems so taken by the elegance of some of his arrangements that he fails to explain how the responses do and do not relate to program objectives. By getting program people to limit their objectives at the outset to what he can evoke, he simplifies his work. It is always hoped (and all to seldom challenged) that there is a high correspondence (the basis for indirect measurement) between the observed response variables and the true criterion response variables.

Were he to have had greater ties with the anthropologist, the journalist, and the poet,* the contemporary evaluator might have dealt himself a more responsive assignment. The principal stimuli then would be those of the program, including responses of students and subsequent dialogue. Somehow (hopefully not imperially) the evaluator would pick and choose what to observe, what to record. He might not be wholly passive; he might find that what is needed requires intervention, stimulation. But he would arrive at that decision (with his client, with his audiences) as a result of his letting the program (its plan, its process, its product) stimulate him. The preordinate evaluator and the responsive evaluator both do some of both, of course.

Portrayals

One of the principal reasons for backing away from the preordinate approach to evaluation is to improve communication with audiences. The responsive approach tries to respond to the natural ways in which people assimilate information and arrive at understanding. It appears that direct experience is an efficient and satisfying way of creating understanding. (The understanding may be misunderstanding, but validity is not the issue at the moment.) Our best substitute for direct experience might be surrogate experience where the observer uses attending- and organizing-paradigms similar to the audience's. Such paradigms are not likely to be those of the specialist in measurement or the theoretically minded social scientist. The surrogate experience

*The poet and these other folks want to stimulate their readers, but they are loathe to stimulate (create phenomena) just so that they have something to write about.

probably will be reported best in terms of persons, places, and events.

It seems that the conventional research-report paradigm is a very unnatural way of communicating. Characteristics (descriptors, traits) are identified; and relationships among them are featured. Individuals are observed, found to differ, and the distribution of scores is described. Covariations of various kinds are reported and interpreted. From such a report it is very hard and often even impossible for a reader to know what the program "was like." If he is supposed to learn what the program "was like," the evaluation report should be different from the research report.

Often the portrayal will feature descriptions of persons. The evaluator will find that "case studies" of several students may more interestingly and faithfully represent the educational program than a few measurements on all the participants. The promise of gain is two-fold. The readers will comprehend and the complexity of the program is not lost. The several participants cannot be considered a satisfactory representation of the many so a sampling error occurs. The protests about the sampling error will be loud; but the size of the error may be small, and it often will be a satisfactory price to pay for the improvement in communication.

The data collected by an evaluator are sometimes represented in a matrix such as this:

	Person					
Variable	1	2	3	4	5	6
A						
B						
C						
D						
.						
.						
.						

(Teacher, class, district project are equivalent ways of categorizing the columns.) The conventional way of aggregating the data is by rows, with scores aggregated over persons. Only a few rows are selected customarily for primary attention. Comparison of groups and correlations are considered on those few variables with individual differences a source of error, depersonalized.

For portrayal, to many audiences, the data should be aggregated by columns. Only a few columns can be given primary attention. These will be the narratives of how a few students were engaged

by the instructional program, how they interacted with teachers and students, how they studied, what they learned, how they felt. It is common knowledge that this approach is useful for discussing programs. The challenge to the evaluator is to minimize the sampling error and to find ways to authenticate this more casual, less "scientific" way of reporting.

Appendix B

GUIDELINES FOR THE EVALUATION OF THE DEL MOD SYSTEM

by

John Bolig
Research Director

DEL MOD RESPONSIVE EVALUATION PROJECT

Overview of the Del Mod System

Background. The Del Mod System has been a five-year educational experiment in Delaware funded primarily by the National Science Foundation (NSF) with large numbers of dollars also coming from the Du Pont Company. The State of Delaware has also contributed monies, and school districts have provided matching funds to support local projects.

In 1970, the systems approach was advocated in Delaware as a means of efficiently and effectively making a massive attempt to improve science education in the state. The idea had the support of the Governor and the Du Pont Company and was presented to the National Science Foundation which had been making plans to attempt a large experiment of this type.

Prior to that time, NSF monies had been disbursed to institutions of higher learning which in turn would sponsor Summer Institutes or Academic Year Institutes to train or retrain science teachers in the various states. There were several problems with that type of intervention, not the least of which was the local loss of teachers who had received the better training. These people were frequently absorbed by industry or by better paying school districts.

Another NSF problem was recognized by 1970. Millions of federal dollars had been spent to develop science curriculum innovations in the form of kits and multi-dimensional programs. These innovations were not widely accepted by schools for a number of reasons, not the least of which was the teacher retraining required to use the materials.

Delaware. Delaware was an ideal location for a broad educational experiment. It is one of the smallest and most compact of states, and demographically it can be shown that it has population components equivalent to those in almost any other state. These components include extremes in distribution of wealth and education, many variations in occupations ranging from industrial chemistry to farming to seaside resort services.

Geographically, Delaware is divided into three counties. The most populous county lies at the northernmost part of the state and it contains Wilmington and its suburbs. The second largest city in the county, Newark, is the seat of the University of Delaware.

The two lower counties are below a canal which connects Chesapeake Bay to the Delaware Bay. This canal is not only a physical reality in Delaware, it is a psychological reality. People below the canal tend to lead a much more leisurely existence than those near Wilmington, and politically they are much more conservative. Higher educational opportunities below the canal

are limited to Delaware State College in Dover and to Delaware Technical and Community College campuses in Dover and Georgetown.

Above the canal, educational opportunities are far greater. Not only do teachers have access to the University of Delaware, but they can attend courses across the Pennsylvania line. Philadelphia is no more than an hour's drive for most people in the county.

Public education in Delaware is primarily funded (71%) by the state legislature. Twenty-six school districts share these funds. Each district has the option of supplementing state funding with local taxes, and this works to the advantage of wealthier localities. Teachers in Wilmington's suburbs are better paid than those in lower Delaware. Their classrooms tend to be better equipped.

The Del Mod System. An assessment of science education in 1969 demonstrated several legitimate needs in Delaware. These included the lack of acceptance of science education innovations and a serious deficiency in teaching skills among several groups of science teachers. These problems occurred more frequently in junior high schools and in areas with little access to colleges or universities.

When Del Mod was created in 1970 it had two broad educational goals. First was the creation of science resource centers easily accessible to all teachers in Delaware. Three of these were created. Secondly, a group of people with highly developed skills in science education were employed as field agents whose jobs entailed improving the teaching of science in grades four to eight in Delaware schools. These people were also expected to promote the use of resource centers.

Once Del Mod had been funded, several other problems were identified. The colleges and the University maintained pre-service and graduate programs for potential teachers of science, and they found it advantageous to Del Mod needs to institute various courses recommended by field agents. School districts interested in improving the quality of instruction in their schools began to request funds to solve local problems. Del Mod itself had several problems which required attention, and an individual was employed to do public relations-type work in dissemination of Del Mod findings.

Structure of the Del Mod System. As it has evolved, Del Mod is governed by the presidents of the University of Delaware, Delaware State College, Delaware Technical and Community College, and the State Superintendent of Public Instruction. These men have ultimate responsibility for all funding and programmatic decisions. They delegate authority within their institutions to various other people concerned with science

education. Each institution has a person at the level of a dean who sits on the Coordinating Council for Teacher Education in Delaware. This body works with the Director of Del Mod to prepare budgets and programs for the presidents' approvals.

At the level of program implementation there are coordinators appointed by each dean. These coordinators are science educators who also meet with the Del Mod Director at frequent intervals.

Del Mod Personnel. In addition to the coordinators mentioned above, there are various other Del Mod employees. These include the Director, a research director, varying numbers of full and part-time field agents, resource center librarians, an instrument repair center technician, two Del Mod technical-report writers, a dissemination specialist, and several secretaries.

Del Mod Funding. Del Mod funds emanating from many sources are all managed by the accounting department of the University of Delaware. Del Mod is charged a modest fee for the handling of these monies. The primary sources of funds have been the NSF and the Du Pont Company. Most Del Mod employees are on the payroll of the component institution they represent, but several people having no institutional ties are paid by the University and have the status of professional staff members.

When Del Mod monies are budgeted each component institution is permitted to draw on the funds held at the University. The Del Mod director also draws on funds to run the central Del Mod office and various statewide programs.

Del Mod Projects. To date there have been 157 Del Mod projects and 6552 people have enrolled in these projects (several having enrolled more than once over the five-year Del Mod history). These projects range from massive one-day workshops to individual teacher curriculum development projects to long-term longitudinal studies of field agent effectiveness.

Del Mod Publications. A brief summary of each project's final report is printed in a Del Mod publication, Del Mod at a Glance, at the conclusion of each fiscal year. The project reports are then filed in the Del Mod office in Dover. In addition, three doctoral dissertations have been prepared using Del Mod topics and data. These are fine examples of scholarly research. A film made of Del Mod personnel at work on various projects has also enjoyed wide circulation. Articles in national journals and Del Mod's monograph series are other materials testifying to various aspects of the System.

Comments. The objective of this overview has been to demonstrate briefly the size and scope of The Delaware Model: A Systems Approach to Science Education. The reader should avoid developing a definition of the word "system" as it applies to this model. We have found no definition which satisfies all conditions. Most Del Mod personnel are willing to discuss their roles in the System at great length and with enthusiasm. but the scope of the System is such that very few people can grasp

all of its functions. Several years ago it was suggested that Del Mod's total impact might be greater than the sum of its various components; on the other hand it could be said that it became too large, too diffuse. Nonetheless, there are many people who are convinced that Del Mod was a worthwhile experiment and that many of its byproducts are worthwhile and transportable to other localities. In our final year we hope to identify these and describe conditions which would enable them to succeed outside of Delaware.

JRB:ds
9/3/75

OBJECTIVES OF THE DEL MOD SYSTEM AND ITS COMPONENTS

Extracted from the First
Del Mod Proposal, February 24, 1971

OBJECTIVES OF THE DEL MOD SYSTEM FOR SCIENCE EDUCATION

The components of the Del Mod System have been developed as the process through which the goals and objectives of the project can be realized. The general goals of the model are:

A. To coordinate all segments of science education in the State so that a maximum impact can be made in reaching all students from pre-elementary through the doctoral level. Science education is defined in the Del Mod System as all University activities and experiences in science and mathematics designed for the specific purpose of preparing a science or mathematics education teacher at the preservice and/or inservice level.

B. To improve the extent and quality of science teaching at the pre-elementary, elementary, secondary and college levels of the State which will result in students who are better educated and have a greater interest in science.

C. To provide a favorable climate for research and development activities in science and education.

D. Specific Objectives of the Del Mod System:

The total Del Mod System and each component within the system will be evaluated in light of the following objectives:

1. Given the proper data, monitoring system, and feedback mechanism, change in science education as reflected through changes in teacher attitudes, pre-service and in-service preparation programs, student attitudes, and student achievement will be demonstrated over a five-year period as a result of research, cooperative planning, pilot projects and pre-service and in-service training.

2. Provided with a cadre of trained science leaders, individual schools, districts, or regions will improve teacher competence, emphasizing an interdisciplinary mix through continuing education programs. The nature and type of these programs will be determined by analysis of present status of science education.

3. Given a group of science education leaders and sources of science education materials, individual schools will develop integrated science curricula with a built-in system for formative and summative evaluation.

4. The schools will incorporate into their on-going programs newly developed science curricula or modification thereof given the proper training both pre-service and in-service, and the sources from which to select materials.

5. Curriculum materials and instructional strategies will be developed, tested, and disseminated in the emergent areas of population environment studies and marine environment studies for classroom teachers K-12.

6. With the proper programs, leadership, and resources, teachers will develop, try out, evaluate, and modify programs, materials, and strategies for varying student ability levels within their classroom for an individualized approach to science education.

7. Science teachers will demonstrate the relationship between mathematics and science in their classroom presentations by incorporating mathematical functions into daily classroom practices. Conversely, mathematical teachers will demonstrate the relationship of mathematics to science by using the process approach to mathematics in their classrooms given the leadership and dissemination techniques to encompass the language and methods common to both.

8. Given the appropriate training a group of educational technicians will demonstrate their contribution to an instructional team under the supervision of certified teachers.

PARTICIPATING INSTITUTIONS AND THEIR ROLES IN THE DEL MOD SYSTEM

The Del Mod System has been designed to enhance the creativity and autonomy of participating individuals and institutions within a cooperative framework. Efforts, in addition to those incorporated in the Del Mod System, designed to improve science education within the elementary and secondary schools of Delaware will be encouraged.

A. Delaware Technical and Community College

Delaware Technical and Community College is a comprehensive multi-campus two-year institution of higher learning that provides academic, technical and continuting educational opportunities for youth and adults in the State of Delaware.

Its purpose is to help students develop their potential in semi-professional and occupational areas and, by so doing, help the community expand its economic base and upgrade its employment force. Admission to either branch of the College is open to all Delaware residents with a high school education or its equivalent or to anyone who is 18 years of age or older and able to benefit from instruction. Its objectives are:

1. Provide for the constantly changing educational needs in a constantly changing community.
2. Provide curriculum closely related to the economic and professional realities of the community.
3. Develop a comprehensive community college with strong emphasis on occupational-technical skills and knowledge.
4. Insure that individuals of all ability levels have access to all programs.
5. Establish the college's identity as a significant member of the community.
6. Develop the individual's ability to contribute to the increase of the economic base of the community.
7. Promote interdisciplinary mix - facilitate student reactions and changing interests.
8. Establish in the minds of the community that the college belongs to them.
9. Develop a strong guidance system - help the student to attain usable education goals.
10. Develop strong emphasis on attitude and motivation training.

While the College technical curricula are strongly job oriented, they are not limited by strict career boundaries. General educational courses are offered to help students develop in the

broader responsibilities of citizenship. Pretechnical course offerings also are available to students preparing themselves for admission to baccalaureate programs in other colleges and universities. In the fall of 1970, non-liberal arts students were enrolled as follows:

Type of Technology	Number of Full-Time Day Students Enrolled
Industrial	20
Chemical	32
Fire	13
Business Administration	274
Data Processing	129
Library	22
Technical Secretarial	120
Civil Engineering	19
Architectural Engineering	129
Electronics Engineering	134
Laboratory	24
Mechanical Engineering	54
Police	61
Dental	19
Pre-Technology	222

Delaware Tech perceives its role in the Del Mod System as part of a consortium to train the science education technician under its Special Occupations Program as well as a participant in the Science Education Resource Center Program.

The College's Special Occupations Program is ideally suited to provide science education technicians with learning experiences since the curriculum would be designed to fit the specific needs of the new occupation: only a few students are accepted in the program so the especially designed courses in addition to a basic core of courses, individualized instructional and counseling help and on-the-job experiences may be provided on a pilot basis.

Students are not placed in the program until a job need is established and employment during and after college determined. The pilot project for the science education technician should be an excellent way to test whether there is a real need for science education technicians without an undue tax burden on the people of Delaware and to test whether senior and junior high school students of all motivational and academic skills levels can be helped by the addition of the paraprofessional in senior and junior high school science classrooms.

B. Delaware State College

The preservice programs in science education presently being operated by Delaware State College are biology, chemistry, mathematics and physics education and a science education program for Middle School teachers. The preservice programs in biology, chemistry, and mathematics education have existed since 1932. The preservice program in physics education was established in 1964 and the preservice science education program for Middle School teachers in 1970. The science and education faculty are jointly involved in the training of science teachers at Delaware State College.

The number of students currently enrolled in each program is:

Biology Education	5
Chemistry Education	2
Mathematics Education	4
Physics Education	0
* Science Education Program for Middle School teachers	0

* Students are currently being recruited for this newly established program.

Six graduates have completed the preservice programs in science and mathematics education during the past five years, three in biology education and three in mathematics education. The number of graduates annually from these programs during the five-year period is as follows:

Preservice Program	1966	1967	1968	1969	1970	Total
Biology Education	2	0	1	0	0	3
Mathematics Education	2	0	0	1	0	3
	4	0	1	1	0	6

In September, 1972, Delaware State College plans to begin offering an In-Service Science Teacher Training Program, in the Evening School, for elementary and secondary school teachers in Kent and Sussex Counties of Delaware particularly. This program will be designed to train area science teachers in the rationale, content and technique of teaching the new science programs. The Coordinator of Science Education at the College and the staff will assist the teachers in incorporating the new materials in their classroom teaching and will assist the schools in Kent and Sussex Counties in improving their science curriculum.

The College plans to increase the size of the science education staff gradually and to establish a Department of Science Education within five years.

Delaware State College will be committed to the Del Mod System in all phases of the pre-service educational program (i.e., preparation of elementary and secondary teachers in science) and in some parts of the in-service training that would normally be found in an undergraduate college. The College will house a Science Education Resource Center Program.

C. University of Delaware

The University of Delaware recognizes that its main business is to promote the intellectual growth of its students in order that they shall make a maximum contribution to the society in which they are going to live. To that end, the University has attempted to establish an ideal community governed by high yet reasonable codes of conduct and dedicated to things of the mind.

The curriculum, the regulations, and the out-of-class activities, at the University of Delaware have been organized over the years for the attainment of three broad goals: that students grow in knowledge to the full extent of their capacity; that its graduates emerge as men and women of demonstrably greater culture than when they entered; and that students develop a sense of responsibility for the public.

The University of Delaware, a land-grant institution, is situated in Newark, Delaware, a city with a population of approximately 19,000. It is located about halfway between Philadelphia and Baltimore. The city of Newark adjoins a major research complex of the chemical industry. The educational and cultural resources of Wilmington, Philadelphia and Washington are within easy reach of the students. The present enrollment is over 15,000. Of this enrollment total, the number of students preparing to teach in science education and mathematics is:

Biology Education	21
Chemical Education	12
General Science Education	5
Mathematics Education	76
Physics Education	2

The number of graduates in each of the science education programs for preparing teachers during the past five years is as follows:

Preservice Program	1967	1968	1969	1970	1971	Total
Biology	5	2	7	10	11	35
Chemistry		1			3	4
Earth Science					1	1
General Sciences	1	2		2	2	7
Physics			1			1
	6	5	8	12	17	48

The University of Delaware is fully accredited by the Middle States Association of Colleges and Secondary Schools, the accrediting agency for this region. Professional programs are given surveillance by appropriate associations such as the Engineers Council for Professional Development, the American Chemical Society, the American Association of Collegiate Schools of Business and the National League of Nursing.

Since it is a land-grant institute, the University recognizes its obligations to the state. As part of its tradition of public service, the University of Delaware assists educational, governmental, professional business and other groups in fulfilling their needs for continuing education. Conferences, seminars, workshops and institutes are popular continuing education techniques among adult groups. Each year the University of Delaware accommodates nearly 200 educational conferences on almost as many different subjects. Attendance ranges from 25 to more than 700 persons. Many conferences are for one day. Last year 41,000 persons came to the University of Delaware to attend some 261 campus conferences on a wide range of subjects. Some institutes last several weeks. Educational programs held include the Development Certificate Program, Refresher courses in Chemical, Civil and Mechanical Engineering in Continuing Education, Continuing Medical Education Seminars for Delaware Physicians and Nurses, Programs in Corrections and Law Enforcement, Seminars on "Women and the Law", and Environmental Resources Seminar.

D. Department of Public Instruction

The Department of Public Instruction is the agency through which the policies and directives of the State Board of Education are transmitted to and implemented in the public schools of Delaware. The State Board of Education has the legal responsibility for general controls and supervision of the public schools in all phases of administration and instructional programs.

The State Superintendent serves as the executive secretary of the State Board of Education and chairman of the Chief School Officers group. The Department of Public Instruction

staff is his direct responsibility and the arm through which policies are carried out.

Within the 126 member staff two individuals are full-time science supervisors, one specializing in elementary science (K-6), and the other responsible for the secondary levels (7-12). In addition the supportive services of the State film library, research division, certification office are available for use by instructional personnel. Supplementing the activities of the science supervisors and working in conjunction with science personnel are supervisors of health, mathematics, vocational programs and Federal programs (ESEA Title I II III, and V, NDEA Title III, EPDA, and others). Under terms of the state plans for the various titles, the content area supervisors approve Federal programs in their areas and assist in program development for respective districts.

Within these broad parameters, the Department of Public Instruction perceives its specific role within the Del Mod System to be:

1. Facilitation of the Del Mod System into the local school programs.

2. Coordination of the activities of the Del Mod System with the local districts.

3. Assessment of needs of teachers and students in science education.

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INDIVIDUAL COMPONENTS

The Del Mod System has been constructed to allow individuality within the existing organizational pattern of each institution, yet all of the participating institutions are bound together by the common threads of: the Science Field Agent Program, the Science Resources Centers, and constant Evaluation Studies. Programs are so conceived as to allow agents access to all Centers and reciprocal agreements between centers for maximum utilization of materials while evaluation activities permeate the heart of all projects as well as the entire system.

A. Science Field Agent

The science field agent component of the Del Mod System is an attempt to give consultative assistance to Delaware science teachers to improve their teaching competence appraise them of newest research findings and assist with the development of programs suitable to their individual classrooms. It may be thought of as patterned after the agricultural extension agent program in which the consultant will go to the teacher. It has been established in the report, Status of Science Teaching in Delaware (Op. Cit.), that 60% of Delaware teachers do not take part in National Science Foundation Institute extension courses of in-service programs. From interviews conducted with a random sample of this 60 percent concerning the lack of participation, several reasons kept recurring.

1. "We give you the time between 8:30 and 3:30 five days a week. At 3:30 we have other obligations and our summers are taken."

2. "The courses are not relevant to the situation in my classroom and do not help me."

3. "It is too far to go to get the course." This comment was noted from persons as little as 10 miles from the University of Delaware.

4. "I don't have to take any courses and I'm on tenure anyway."

In addition, the same sample of teachers were asked to state the conditions under which they would seek improvement. Consistently the replies reflected the following major reasons:

1. "If course can be held during school hours."

2. "If the courses can be held at my school or a neighboring school."

3. "If the courses are really going to help me improve my teaching, in my situation and not just a lot of theory."

Based on these earlier findings four work groups at the conference on the Del Mod System (September 18, 1970) (see Appendix for "Proceedings") were asked to construct a job description for a field agent and describe the services the agent should perform. The collective picture which emerged could best be described as "a supervisor/coordinator without administrative responsibilities."

Within the Del Mod System the field agents are therefore construed as the links which tie the System together and institutionalize the curriculum materials and methods developed by the research centers. In short, the characterization word, "IMPLEMENTOR" is analagous to field agent.

University/College Role

Research — Development

Feedback — Implementation

Field Agent Role

Objectives

As a part of the Del Mod System the science field agent will:

1. Establish a liaison between the institutions of higher education, research centers, curriculum projects, state agencies and the classroom teacher within designed levels and geographic areas.
2. Construct, adapt or utilize any techniques needed to improve teacher competencies.
3. Conduct a wide variety of inservice activities designed to meet the needs of science teachers as determined by baseline data study, conferences with local supervisors, the state science supervisor, teachers, and others.
4. Disseminate information about and serve as implementors for materials and methods developed by curriculum projects of the Del Mod System and other institutions.

Relationship of Field Agents to Director, Component Coordinators, State Science Supervisor and the Resource Centers

The field agents will be directly responsible to the director for fiscal accountability and program approval. The kinds of programs which are conducted and their function will be constructed as a result of the feedback data from the advisory committee, state science supervisor, schools, and component coordinators and

the baseline data survey. Any change in the format of a particular program will be one by mutual agreement between the agent and director after careful assessment of the available data.

The component coordinator's relationship to the field agent will be indirect insofar as program development is concerned and will be through the director. The connection will be direct when the agent utilizes the materials produced by project directors through the coordinator as a part of his teaching resources. Such materials as those constructed by the Marine Science Project, the Population Education Project and others exemplify this concept. After using the materials, the agent will feed back to individual project directors through the component coordinator any assessment of the success of the materials or their needed modifications.

The field agent's relationship to the state science supervisor will also be direct for program development and cooperatively done with the director. The connection between the agent and the state science supervisor will facilitate the entry of the agent into the public and parochial schools. The degree of facilitation needed in some instances will be minimal while in others may be considerable.

All agents will operate out of the resource centers located on the campuses of Delaware Technical and Community College, Delaware State College and University of Delaware. They will be responsible for purveying the materials in the centers, encouraging teachers to use the materials and, in short, be the individual who brings the center to the teacher. The science resource centers will also serve as the locus for the many inservice activities conducted by the field agent.

Special Requirements

The following professional requirements are suggested as a guide for the selection of field agents:

1. A bachelor's degree in science or science education.
2. A master's degree in science or science education.
3. At least five years of successful classroom teaching experience.
4. Ability to relate to adults as determined by recommendation of immediate supervisor, peers, or college/university advisor.
5. Leadership qualities as determined by preparation, personal interview and recommendation of individual(s) competent to determine.
6. Recent training in modern curriculum techniques and strategies.

Operational Philosophy

The operational philosophy for the position of science field agent for the Del Mod System is predicated on the premise that improvement in day-to-day classroom practices can only be accomplished over a long period of time and through intimate, sustained contact between the teacher and an individual trained in affecting behavioral changes. It does not imply supervision and administration of district state or university/college programs, supervision of teachers or involvement with specific state, district or college/university operations. It is construed to involve liaison between all segments of the industrial/scientific/educational, communities and the classroom teacher in a non-threatening manner.

Duties

The duties of a field agent within the Del Mod System are:

1. Together with the director, following the identification of needs and the establishment of priorities by the Advisory Committee, plan implementation strategies for meeting needs of target population designated for the agent.

2. Devise strategies, materials, methods of satisfying the needs of the target group.

3. Utilize all of the resource center materials to fulfill needs of the target group.

4. Interpret to teachers the intent of a resource center and stimulate the teachers to use the centers.

5. Visit individual teacher classrooms of the target group to follow through with strategies developed in group sessions and give advice and counsel where needed.

6. Keep abreast of latest findings in research, curriculum development and science education.

7. Be responsible for maintaining accurate records of techniques, successes, failures, and any test results of target group.

8. Meet periodically with Project Director, Advisory Committee, and Component Coordinators to review progress with target group and plan future strategies.

9. Provide constant feedback data on needs, problems and assessment of individual competencies.

10. Construct an open communication channel between state agencies, university/college and the classroom teachers so that a constant flow of information is maintained (liaison).

Responsibilities and Contractual Agreements

The field agent will be directly responsible to the project director for planning and directing activities. He will be fiscally accountable to the Augmented Council of Presidents. He will not serve as an arm of the institution in which he is housed for teaching, administrative or supervisory functions. For purposes of retirement, health benefits and longevity of service, he will be considered as a state employee. Employment will be on a 12-month basis.

A contract will be issued by the Augmented Council of Presidents for the Del Mod System with the salary to be determined by the aforesaid terms and on a yearly basis.

B. Science Resource Centers:

A major problem faced by teachers, administrators, in-service education leaders and supervisors is that of obtaining available materials from which to build programs suitable for their classroom needs. In Delaware, as elsewhere, there are small curriculum centers, often a closet, housing minimal materials. These materials are largely an odd assortment of textbooks collected in a rather haphazard manner and in most cases, without the related visual materials. Many districts set aside time, hold summer workshops, have in-service programs for specific purposes only to find that the gain is negated by the paucity of materials available to them. The only center in the State is on the University of Delaware campus and this, too, is textbook-oriented, small and does not adequately serve the needs of pre-service student teachers or begin to provide those services needed by the teachers in the more populous areas.

At various times during the year, teachers are asked to order materials and purchase textbooks. Frequently, these materials are contracted for only on information obtained from brochures, word of mouth from other teachers or supervisors, catalogues or brief inspection of limited samples. The old adage, "buying a pig in a poke" seems to typify the manner in which many curriculum materials find their way into classroom usage.

The Del Mod System proposes to set up a strategic location in the state resource centers for use of all science education personnel. These centers are envisioned as the pivots around which all phases of the Del Mod System revolve and the locus for activities.

Objectives of Resource Centers:

The objectives for the resource center component of the Del Mod System are:

1. To establish a resource library for teachers, student teachers and technicians where they may examine or borrow on a limited basis materials and equipment, textbooks, trade catalogues, films and other audio-visual material and other items.

2. To make available a physical facility where local district supervisors, teachers, science groups, pre-service teachers can meet to develop their own programs surrounded by the materials needed.

3. To provide an operational base for the field agents' activities.

4. To define a locus for conducting in-service education programs, community science groups' meetings and others.

Physical Operation of Each Center

Each center will be staffed with a full-time technician or the equivalent. This technician will be responsible for cataloguing the collection, keeping track of materials, replacing expended supplies, setting up a system for borrowing materials, act as an arm of the field agent or in-service instructor in securing materials needed for programs and assist teachers in finding specific materials. For the above reasons the library technician will be expected to be familiar with all materials in the particular center and the operation of all equipment.

The library technician will be considered an employee of the housing institution and subject to all benefits, privileges and regulations of each institution.

Each library technician will be assisted by student secretarial help. It is assumed that this will be approximately 15 hours per week or as deemed feasible by each institution. It is suggested that centers operate from 10:00 a.m. to 10:00 p.m. throughout the calendar year, except during the regular vacation periods of the housing institution.

The centers will not be open to students unless accompanied by their teacher and for specific purposes. It is not the intents of the centers to provide science resources but rather teaching resources.

Relationship to Field Agents

One of the obstacles which has made the operation of the previously described junior high school project with the field agent more diffecult is that the program has no permanent home and all materials must be transported between their storage area in the Townsend Building in Dover to Delaware State College and Delaware Technical and Community College, Georgetown. Of necessity these materials must be easily packed, relatively light weight and transportable. Fortunately, other than the inconvenience incurred, the type of materials needed for the present program (Junior High School Retraining Project) do lend themselves to the above-mentioned criteria. However, as field agent programs move into high school areas and more agents become operative, such an arrangement may not always be the case. Therefore, for the most expeditious use of the field agent's time all the materials needed should be housed in the centers.

The center will serve as the physical facility in which the agent carries on his activities when not in a particular building. He may use the center for conducting retraining activities, conferences, curriculum development, microteaching or other teacher improvement practices. He will retain a desk, files, and other pertinent equipment in each center. Likewise, the center from which the agent operates will assume the responsibility of accounting for the agent's whereabouts and as a contact point for him.

It will be the agent's responsibility as part of his activities to inform teachers about the contents of the centers and encourage usage of the centers by teachers on their own, as well as under the agent's tutelage.

Evaluation of Effectiveness of the Centers

Since the centers are considered to be the core around which the features of the Del Mod System revolve, the following procedures will be used to determine usage:

1. Daily records will be kept of the number of people who use the center and of the times the center is used.

2. Accurate accounts will be maintained on what kinds of material are borrowed and used at the center. In addition, a running tally will be kept of the kind and amount of supplies used. It is imperative that this information be available for planning the third and fourth centers.

3. Records will be established on the number and nature of in-service activities carried on here by district, college, university, state and community personnel. This type of information is currently available at DPI for use as a benchmark.

4. Field agents will file periodic reports on their use of the center.

5. As a result of the baseline data study, details on the kinds of programs conducted in the schools and the materials currently in use will be available. The monitoring system set-up will be able to measure program change in materials. If the changes in programs coincide with the individuals who use the centers, it will be assumed that the change results from exposure to materials and activities within the centers. Another cross check for this kind of information might be noted on NDEA equipment and materials list.

6. Evidence of center usage and effectiveness will be submitted to the project director who in turn will incorporate the information in his annual report.

C. Director

The operational philosophy for the position of Project Director for Del Mod System for Improvement of Science Education is predicated on the premise that one individual is needed to coordinate the various aspects of the Del Mod System. The position of Director does not involve teaching, direct involvement with any specific projects, supervision of teachers, or involvement with any ongoing activities within the respective institution, but is construed to entail liaison between all participating institutions, federal agencies, private agencies, industry and professional societies.

The objectives for the position of the Project Director of the Del Mod System are:

1. To establish a climate of leadership in order that the Del Mod System will become operative.

2. Carry out policy decisions of the Augmented Council of Presidents as they relate to the Del Mod System.

3. Prepare and submit a quarterly report of the activities of the Del Mod System to the Augmented Council of Presidents.

4. Prepare and disseminate to all concerned an annual report of the activities of the Del Mod System.

5. Serve as liaison person between all parties.

6. Interpret the Del Mod System to educators, industrialists and/or laymen.

7. Supervise and direct the activities of the field agents.

8. Prepare and submit, with the advice and consent of the Advisory Committee and Component Coordinators, to funding agencies overall proposals and letters of endorsements.

9. Prepare operational budget for Del Mod System, review financial expenditures, work with funding agencies, Advisory Council, Component Coordinators, and Augmented Council to facilitate the reprogramming of assigned funds.

10. Plan and implement a system-wide evaluation design to assess impact of Del Mod System's overall effect on improvement of science education.

11. Coordinate all activities of Del Mod System.

12. Exercise leadership in revising overall plan and introducing innovation and experimentation into the Del Mod System.

13. Work with each component coordinator in carrying out assigned roles.

14. Serve as adjunct member of advisory committee.

15. Keep abreast of current developments in science education.

16. Select staff for field agents for approval by Augmented Council of Presidents.

Function and Responsibilities

Employment will be cooperatively arranged by the Augmented Council of Presidents and be for a period of 12 months. The joint appointee will not serve as an arm of the administrative or supervisory services of any particular institution but would work in close cooperation with these services as well as individual component coordinators. He will be housed in suitable facilities as provided by one of the member institutions. In addition, for purposes of retirement benefits and longevity of service, he will be construed as a state employee.

D. Data Analyst: (now known as Research Director)

The operational philosophy for the position of data analyst for the Del Mod System for the Improvement of Science Education in Delaware if predicated on the premise that without adequate baseline data and a system for data retrieval with provisions for constant monitoring any systems approach to education is

doomed to failure. Since it is impossible to quantify success unless care has been taken to assess where you begin, it is imperative that a data system be initiated before the operation of the Del Mod System begins. The position does not involve supervision of teachers nor a comparison study between teachers, schools or districts.

Objectives

The objectives for the position of data analyst are:

1. To construct a suitable instrument for determining the background and preparation of all full-time secondary teachers (full time may be defined as teaching three science classes).

2. To construct a suitable instrument for the random sampling of the background and preparation of elementary teachers.

3. To administer such instruments as described above to determine teacher background and preparation.

4. In consultation with science education personnel, to select and administer a suitable instrument for the assessment of teacher attitudes toward science.

5. To select and administer to random samples of the student population suitable instruments designed to measure student achievement in various disciplines.

6. To select and administer to random samples of the student population suitable instruments designed to measure student attitudes toward science.

7. To write appropriate programs for retrieval of the data.

8. To set up monitoring procedure for the system.

9. To perform any other duties as determined by the component coordinator.

Functions and Responsibilities

The data analyst employed by the Del Mod System will be directly responsible to the Director. He will be housed in the Director's staff office and have access to secretarial assistance. He will have access to all teacher records on file in the Department of Public Instruction. He will consult with each institutional component coordinator to determine the kinds of information desired and their uses of the information. He will be issued a yearly contract as an employee of the Del Mod System and salaried from the Del Mod agency account.

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DEL MOD RESPONSIVE EVALUATION PROJECT

EVALUATION ISSUES

As explained to you during your orientation to this evaluation project, it may be worth your while to explore possible issues during your travels to Resource Centers, visits with field agents, and other activities.

On the following pages are several models of issues you may wish to consider. They are meant to serve as guidelines - not as objectives of your evaluation.

There is also a two-page table of personnel and functions of Del Mod you may wish to consult before entering any institution.

A ISSUES

Resource Centers

1. In what ways are Resource Centers cost-effective?

2. How are teachers attracted to Resource Centers, and what training is required for proper use of a Resource Center?

3. What is the ideal role of Field Agents related to Resource Centers?

4. Does preservice (undergraduate) training in the use of Resource Centers guarantee future inservice use of the Center? Why, why not?

5. Which aspects, duties, or functions of Resource Centers must prevail if a Center is to be created and used effectively?

6. Is geographical location of a Resource Center a critical factor? Is parking a factor? Are operating hours a factor?

7. How valuable are Resource Centers in their direct support to schools? Do newsletters have an effect on the proper use of Resource Centers?

8. What personality factors must exist in the Director of a Center if it is to be effective?

B ISSUES

Field Agents

1. Are Field Agents cost-effective? How?

2. Have Field Agents replaced local district science and mathematics supervisors? How? Why?

3. Do Field Agents pose a threat to teachers? Why, why not?

4. Are Resource Centers critical to Field Agents as they perform their duties? How?

5. How are Field Agents selected and trained? Are there personality or educational factors which are important?

6. What administrative duties (paper work) must be performed by Field Agents? If they do not perform these tasks, is a central administrator required?

7. Which conditions must prevail if Field Agents are to function efficiently?

8. Should Field Agents perform any evaluation function? Why, why not?

C ISSUES

Systems Approach

1. Which political, financial, or philosophical factors must exist if a Systems Approach is to be started and if it is to succeed?

2. Is geography a factor? Is population a factor? Is the presence of colleges or universities critical?

3. How do you evaluate a System, internally or externally?

4. Is a Systems Approach cost-effective? How?

5. What governing structures are critical if a multi-institutional Systems Approach is to succeed?

6. How does the System accommodate itself to unexpected contingencies? (Is the System flexible? How?)

7. How is a Director selected or trained to manage a System?

DEL MOD PERSONNEL LISTED BY TITLE WITHIN EACH INSTITUTION

THESE PEOPLE CAN BE REACHED FOR APPOINTMENTS AT THE PHONE NUMBER HEADING EACH COLUMN

Personnel	738-1230 U Del	678-5235 Del State	678-7711 Del Tech	678-4885 DPI	678-4513 Del Mod
President	Dr. Trabant	Dr. Mishoe	Mr. Weatherly[3]	Dr. Madden	_____
Dean	Dr. Neale	Dr. McKinney	Dr. Laws[3]	Mr. Broyles	Mrs. Purnell
Coordinator	Dr. Knight	Mr. Hazelton	Mrs. Lantis[1]	Mr. Reiher	Dr. (Bolig)
Field Agent	Mr. Shannon Ms. Logan	Dr. Cowan	Mr. Gussett[1]	Mr. (Reiher)	_____
Resource Center Librarian	Dr. Uffelman	Mr. Gardner	Mrs. Sloan[1]	_____	_____
Repair Center Technician	_____	_____	Mr. Sutcliffe[2]	_____	_____
Researcher	Dr. Bausell	_____	_____	Dr. (Wise)	Dr. Bolig
Disseminator	_____	_____	_____	Mr. Baker	Mr. Golts
Secretary	Mrs. Pontius	Mrs. Davis	_____	Mrs. Fifer	Mrs. Starcher

1 - Georgetown
2 - Stanton
3 - Dover

DEL MOD FUNCTIONS WITHIN EACH INSTITUTION

Courses & Programs	University of Delaware	Delaware State	Delaware Tech
Preservice	Yes	Yes	No
In-service	Yes	Yes	No
Graduate	Yes	No	No
Workshops	Yes	Yes	Yes[1]
History	Yes	Yes	Yes
Finances	Yes	Yes	Yes
Instrument Repair	No	No	Yes[2]
Resource Center	Yes	Yes	Yes[1]
Certification	No	No	No
Curriculum Dev.	Yes	No	No
Research	Yes	No	No
Projects			
Local District	No	No	No
Individual Teacher	No	No	No

1 - Georgetown
2 - Stanton
3 - Dover

Appendix C

EVALUATORS

EVALUATOR	REPRESENTING	INVITED BY
Mrs. Essie Beck Personnel Evaluator	Jefferson Parish Public Schools	DPI
Mr. Michael Brophy Consultant for Planning and Evaluation	New Hampshire State Dept. of Education	Del Mod
Dr. Kenneth W. Dowling Science Consultant	Wisconsin State Dept. of Education	Del Mod
Dr. William E. Gardner	University of Minn.	UD
Dr. Newman A. Hall		UD
Dr. Edward E. Johnson	Rutgers University	UD
Dr. Frederick Johnson Science Consultant	Selby County Schools Memphis, Tenn	DPI
Mr. John Kinsler Teacher	De La Warr H. S.	Del Mod (field agents)
Dr. Thomas T. Liao College of Engineering and Applied Science	SUNY at Stony Brook	DTCC
Mr. Keith A. McKain Teacher	Milford Senior H. S.	Del Mod (field agents)
Dr. Robert W. Menefee Division of Mathematics and Science	Montgomery College	DTCC
Dr. John Ogle Supervisor of Mathematics	North Carolina State Dept. of Public Instruction	DPI
Dr. Alan R. Osborne College of Education	Ohio State University	DPI
Dr. Douglas Reynolds Associate Supervisor, Science Education	New York State Dept. of Education	DPI
Dr. Ertle Thompson	University of Virginia	UD
Mrs. Shirley Truitt Teacher	Selbyville Middle School	Del Mod (field agents)
Mrs. Yvonne Welch Teacher	Marbrook Elementary School	Del Mod (field agents)

THE FOLLOWING TWO EVALUATORS FAILED TO REPORT:

EVALUATOR	REPRESENTING	INVITED BY
Dr. Margery Gardner Assistant Dean of School of Education	University of Maryland	DPI
Dr. Glenadine Gibb	University of Texas at Austin	DPI